

Appln No. 10/603,082  
Zaiqian HU  
Office Action dated April 21, 2004

This listing of claims will replace all prior versions and listing of claims in the application.

LISTING OF CLAIMS

1. (cancelled)

2. (currently amended) A heat exchanger comprising:

a first end tank;

a second end tank opposite the first end tank;

a first tube in fluid communication with the first and second end tanks, the first tube adapted to have a first fluid flow therethrough, the first tube having a hydraulic diameter less than about 1.00 mm;

a second tube in fluid communication with the first and second end tanks, the second tubes adapted to have the first fluid flow therethrough after the first fluid flows through the first tube, the second tube having a hydraulic diameter less than about 1.00 mm;

at least one fin contacting the first tube and the second tube, with the first and second tubes and the fins being generally co-planar relative to each other;

wherein the heat exchanger is a single pass or two-pass exchanger, the fin height is less than or equal to about 10.0mm and

A heat exchanger as in claim 4 wherein the hydraulic diameter of the first tube or second tube is less than about 0.6 mm.

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3. (currently amended) A heat exchanger as in claim 2 wherein the hydraulic diameter of the first tube or second tube is less than or equal to about 0.5 mm, ~~and wherein the heat exchanger is a single pass exchanger.~~

4. (currently amended) A heat exchanger comprising:  
a first end tank;  
a second end tank opposite the first end tank;  
a first tube in fluid communication with the first and second end tanks, the first tube adapted to have a first fluid flow therethrough, the first tube having a hydraulic diameter less than about 1.00 mm;  
a second tube in fluid communication with the first and second end tanks, the second tubes adapted to have the first fluid flow therethrough after the first fluid flows through the first tube, the second tube having a hydraulic diameter less than about 1.00 mm;  
at least one fin contacting the first tube and the second tube, with the first and second tubes and the fins being generally co-planar relative to each other;  
wherein the heat exchanger is a single pass or two-pass exchanger and ~~A heat exchanger as in claim 4~~ wherein the first tube and second tube define a plurality of sub-passageways extending along a length of the first tube and second tube wherein each of the sub-passageways of the first tube and second tube have a cross-sectional area perpendicular to the length of the first tube and second tube that is between about 0.02 mm<sup>2</sup> and about 1.00 mm<sup>2</sup>.

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5. (currently amended) A heat exchanger comprising:

a first end tank;

a second end tank opposite the first end tank;

a plurality of first tubes in fluid communication with the first and second end tanks, the plurality of first tubes adapted to have a first fluid flow therethrough, the plurality of first tubes each having a hydraulic diameter less than about 1.00 mm;

a plurality of second tubes in fluid communication with the first and second end tanks, the plurality of second tubes adapted to have the first fluid flow therethrough after the first fluid flows through the plurality of first tubes, the plurality of second tubes each having a hydraulic diameter less than about 1.00 mm;

at least one fin contacting the one or the plurality of first tubes and at least one of the plurality of second tubes, with the first and second tubes and the fins being generally co-planar relative to each other; and

wherein the fin height is less than or equal to about 10.0mm; ,  
and wherein each first tube defines a plurality of sub-passageways extending along a length of each first tube wherein each of the sub-passageways of each first tube has a cross-sectional area perpendicular to the length of each first tube that is between about 0.02 mm<sup>2</sup> and about 1.00 mm<sup>2</sup>.

6. (original) A heat exchanger as in claim 5 wherein the hydraulic diameter of each first tube is less than about 0.6 mm, and the fin height is less than or equal to about 9.0mm.

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7. (original) A heat exchanger as in claim 6 wherein the hydraulic diameter of each second tube is less than or equal to about 0.5mm, and the fin height is less than or equal to 8.0mm .

8. (cancelled)

9. (currently amended) A heat exchanger as in claim 8 wherein each second tube defines a plurality of sub-passageways extending along a length of each second tube wherein each of the sub-passageways of each second tube has a cross-sectional area perpendicular to the length of each second tube that is between about 0.02 mm<sup>2</sup> and about 1.00 mm<sup>2</sup>.

10. (currently amended) A heat exchanger comprising:

a first end tank;

a second end tank opposite the first end tank;

a plurality of first tubes in fluid communication with the first and second end tanks, the plurality of first tubes adapted to have a first fluid flow therethrough, the plurality of first tubes having a hydraulic diameter less than or equal to about 0.40 mm and greater than or equal to about 0.15mm;

a plurality of second tubes in fluid communication with the first and second end tanks, the plurality of second tubes adapted to have the first fluid flow therethrough after the first fluid flows through the plurality of first tubes, the plurality of second tubes each having a hydraulic diameter greater than or equal to about 0.15mm; and

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a plurality of fins disposed between the pluralities of first and second tubes, with the pluralities of first and second tubes and the plurality of fins being generally co-planar relative to each other;

wherein the first tube and second tube define a plurality of sub-passageways extending along a length of the first tube and second tube wherein each of the sub-passageways of the first tube and second tube have a cross-sectional area perpendicular to the length of the first tube and second tube that is between about 0.02 mm<sup>2</sup> and about 1.00 mm<sup>2</sup>.

11. (currently amended) A heat exchanger comprising:

a first end tank;

a second end tank opposite the first end tank;

a first tube in fluid communication with the first and second end tanks, the first tube adapted to have a first fluid flow therethrough;

a second tube in fluid communication with the first and second end tanks and the first tube wherein the second tube has a substantially identical diameter as the first tube and wherein the second tube is adapted to have the first fluid flow therethrough after the first fluid flows through the first tube;

at least one fin contacting the first tube and the second tube, with the first and second tubes and the fins being generally co-planar relative to each other;

wherein the first tube and second tube define a plurality of sub-passageways extending along a length of the first tube and second tube wherein each of the sub-passageways of the first tube and second tube have a cross-sectional area perpendicular to the length of

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the first tube and second tube that is between about 0.02 mm<sup>2</sup> and about 1.00 mm<sup>2</sup>.

12. (currently amended) A heat exchanger comprising:

a first end tank;

a second end tank opposite the first end tank;

a plurality of first tubes in fluid communication with the first and second end tanks, the plurality of first tubes adapted to have a first fluid flow therethrough, the plurality of first tubes having a hydraulic diameter less than about 1.00 mm;

a plurality of second tubes in fluid communication with the first and second end tanks, the plurality of second tubes adapted to have the first fluid flow therethrough after the first fluid flows through the plurality of first tubes, the plurality of second tubes each having a hydraulic diameter less than about 1.00 mm;

a one or a plurality of third tubes in fluid communication with the first and second end tanks, the third tubes adapted to have a fluid flow therethrough; and

a plurality of fins disposed between the pluralities of first and second tubes and the plurality of fins being generally co-planar relative to each other;

wherein at least one of the one or a plurality of third tubes, and the plurality of first tubes or the plurality of second tubes, has tubes that define a plurality of sub-passageways extending along a length of at least one of the one or a plurality of third tubes and the plurality of first tubes or the plurality of second tubes and wherein each of the sub-passageways of the tubes having a plurality of sub-passageways have a cross-sectional area perpendicular to the

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length of the first tube and second tube that is between about 0.02 mm<sup>2</sup> and about 1.00 mm<sup>2</sup>.

13. (original) A heat exchanger as in claim 12, wherein the third tube or plurality of tubes are above or below the first and second plurality of tubes.

14. (currently amended) A heat exchanger as in claim 4, wherein a core depth of the heat exchanger is between 6.0 and 27.00mm.

15. (new) A heat exchanger comprising:

a first end tank;

a second end tank opposite the first end tank;

a first tube in fluid communication with the first and second end tanks, the first tube having a hydraulic diameter less than about 1.00 mm and having a plurality of sub-passageways extending along a length of the first tube and second tube wherein each of the sub-passageways of the first tube;

a second tube in fluid communication with the first and second end tanks, the second tube having a hydraulic diameter less than about 1.00 mm and having a plurality of sub-passageways extending along a length of the second tube;

at least one fin contacting the first tube and the second tube, with the first and second tubes and the fins being generally co-planar relative to each other;

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wherein each of the sub-passageways of the first tube and second tube have a cross-sectional area perpendicular to the length of the first tube and second tube that is between about  $0.02 \text{ mm}^2$  and about  $1.00 \text{ mm}^2$ ;

wherein the heat exchanger is a single pass or two-pass exchanger.

16. (new) A heat exchanger as in claim 15 wherein the hydraulic diameter of the first tube or second tube is less than about 0.6 mm.

17. (new) A heat exchanger as in claim 16 wherein the hydraulic diameter of the first tube or second tube is less than or equal to about 0.5 mm, and wherein the heat exchanger is a single pass exchanger.